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DEPARTMENTS.

SOLUTIONS OF PROBLEMS.

ALGEBRA.

275. Proposed by R. D. CARMICHAEL, Anniston, Ala.

Given the simultaneous equations $x^y - y^x = 0$ and $y - x = a(a+1)^{1/a}$; find a solution which is real when $a > -1$.

Solution by A. H. HOLMES, Brunswick, Maine, and L. E. NEWCOMB, Los Gatos, California.

$x^y = y^x \dots (1)$; $y - x = a(a+1)^{1/a} \dots (2)$. Put $y = x^z$. Then in (1) $x^{x^z} = x^{zx}$. $\therefore x^z = zx$. From (2), $x(x^{z-1} - 1) = a(a+1)^{1/a}$, or $x(z-1) = a(a+1)^{1/a}$. Take $(z-1) = a$. Then $x = (a+1)^{1/a}$, $z = a+1$, $y = zx = (a+1)^{(a+1)/a}$. Putting for y and x these values in (1),

$$(a+1)^{(1/a)(a+1)^{(a+1)/a}} = (a+1)^{[(a+1)/a](a+1)^{1/a}};$$

$$\frac{(a+1)^{a+1}}{a} \log(a+1) = \frac{a+1}{a} \times (a+1)^{1/a} \log(a+1); \text{ and}$$

$$\frac{a+1}{a} = \frac{a+1}{a}.$$

$\therefore x = (a+1)^{1/a}$ and $y = (a+1)^{(a+1)/a}$, which are real when $a > -1$.

Also solved by G. B. M. ZERR and J. Scheffer.

No solution of 276 has yet been received.

GEOMETRY.

303. Proposed by FRANCIS RUST, C. E., Allegheny, Pa.

Prove that the pedal line of any point on a triangle's circum-circle bisects the distance from this point to the triangle's ortho-center.

Solution by G. B. M. ZERR, Ph. D., Parsons, W. Va., and J. SCHEFFER, A. M., Kee Mar College, Hagerstown, Md.

Let H be the ortho-center, P the given point, EF the pedal line intersecting PH in O . Produce the perpendicular BR to meet the circumference in M , and produce PE to meet the circumference in L , also take $EQ = PE$.

Quadrilateral $PEFC$ is inscriptible; $\angle PCF =$ supplement of angle PLB , both measured by $\frac{1}{2}$ arc PAB .

$\therefore \angle PEF$, the supplement of $\angle PCF = \angle PLB$. $\therefore EF$ is parallel to LB .

Now $RM = RH$, $PD = EQ$, hence the trape-

